SOME POINTS IN THE EXTERNAL MORPHOLOGY OF THE POUCH YOUNG OF THE MARSUPIAL, *THYLACINUS CYNOCEPHALUS* HARRIS.

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(Plate i; three Text-figures.)

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The Tasmanian Wolf (*Thylacinus cynocephalus* Harris) seems in danger of being added to the growing list of extinct marsupials. As long ago as 1842 Owen felt constrained to comment that its "term of existence seems fast waning to its close". The animal, unique in many respects among marsupials, is a more than usually interesting component of the Australian fauna, but after a history in literature which commenced in 1808 there are still many gaps in our knowledge concerning it.

The present contribution deals with the external features of the pouch young of which little of moment has hitherto been published. An account, gathered from adult material, of the hair tracts in the groin of the male is added for comparison.

Acknowledgments.

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Material.

The specimens on which these observations were made are in three groups from three different collections as follows:

(*a*). *Australian Institute of Anatomy.*—The formalin-preserved carcase of a mature male (length of head and body 1170 mm., tail 480 mm.) skinned except over the groin, tail, parts of the face, and the distal ends of the limbs. In addition, there are two mounted wet preparations of the scrotum and its investing pouch. This material will be referred to as the "*A.I.A.* series".

(*b*). *Australian Museum.*—Register number 762—a very young furred female (length of head and body 288 mm., tail 119 mm.) probably still at a stage when using the shelter of the pouch and being suckled.* It will be recorded as the "*A.M.* female".

(*c*). *National Museum.*—Register numbers R.3025–8—four almost naked litter mates (crown-rump length approximately 75 mm.) comprising two males and two females. They will be referred to as the "*N.M.* litter".

So far as can be ascertained there are no juvenile stages housed in Australian collections other than those listed above.

Hair.

N.M. litter.—These four individuals are naked except for the sensory vibrissae of the face and some hair, very pale brown in colour, on parts of the head. The development of hair on the head has not proceeded at the same rate in all parts, and this, combined with its distribution, has in the stage under consideration produced a pattern which is constant throughout the litter. The hairs are furthest advanced on the face between the ear and the eye above a sharply defined line joining the lateral angle of the

* Owen (1868), writing of the pouch in *Thylacinus*, records that "In a female which carried there three young, each 1 foot in length from the snout to the end of the tail, the length of the pouch was 8 inches".

eye to the lower limit of the base of the ear. The crown of the head is also haired; the hairs of this area are continuous laterally with those in front of the ear as described above, extend forward to the rhinarium, and finish on an arc, convex cranially, which runs transversely between the upper limit of the bases of the ears. A few scattered hairs have pierced the skin of the head more caudally. As is usual in marsupial embryos there is a growth of fine hairs on the regions where tactile vibrissae are situated. There are also hairs on the lower eyelid and in its vicinity.

A.M. female.—The body is invested by a close rather coarse fur which shows even at this early age the crispness found in the adult. The hairs are longest on the face immediately in front of the ear; they are relatively pale and sparse on the ventral surface from and including the neck back to the root of the tail, and on the medial aspects of the limbs. The pelage consists of longer and stouter guard hairs overlying a more delicate under-fur.

Pigmentation.

N.M. litter.—Transverse markings on the back in the caudal half of the body are not apparent. There is present, however, in parts of the skin, a grey pigmentation which follows a fairly consistent pattern in each of the four litter mates. The pigmentation is most marked on the head somewhat above the level of the definitive lip line. It is relatively concentrated beneath the eyes, and on the muzzle cranial of a transverse line which runs across the head from slightly caudal of the medial canthus on each side; further back the pigment intensity is weak and dorsally and laterally it is negligible behind the level of the vertex. The lateral surface of the ear shows pigmentation in front of the meatus comparable in intensity with that on the muzzle; there is a weaker irregular distribution on the auricle generally. A pigmented circular area on the chin has ill-defined boundaries and a diameter rather larger than that of the mouth aperture. In addition, the tail is pigmented (weakly in the distal half) except for three or four millimetres at its root, and there is a tendency for similar colour to develop on the dorsum of the fore- and hind-feet.

A.M. female.—The characteristic transverse bands of the hinder half of the body are clearly laid down (Plate i, fig. 1) and are indistinguishable from those found in the adult condition.

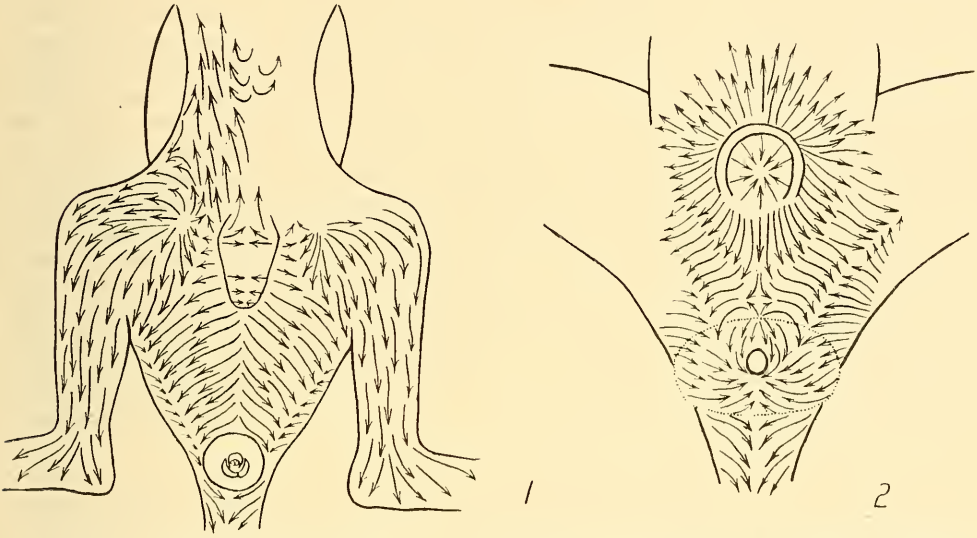
Hair Tracts.

A.M. female.—The hair tracts of this individual have been described elsewhere (Boardman, 1943*b*). The account given of the groin was incomplete for the reason stated, and provision of a figure was deferred in the hope of securing further material. There appears to be little chance of this hope being realized, so that I am here supplementing the previous description by a figure (Fig. 1) which is as comprehensive as the specimen will permit.

Pocock (1926), in describing an adult female, records that "The hairs on the abdomen surrounding the pouch were directed towards it, as in the case of the male; and between the pouch and the cloacal orifice the points of the hairs were directed inwards towards the middle line, leaving a narrow strip of naked skin forming an ill-defined passage between that orifice and the mammary area (Text-fig. 42, p. 1066)". It will readily be seen by reference to the accompanying figure and previous description based on data provided by the young *A.M.* female, that the two accounts of the hair disposition are not reconcilable. The difference is similar to that found when comparing Pocock's account of hair arrangement in the vicinity of the scrotal pouch of the male (*v. infra*) and, in view of the fact that the crisp nature and shortness of the adult hair seems admirable for the preservation of the gross features of the hair tracts at all ages, the discrepancy is difficult to understand. Moreover, Pocock's description would imply the presence on the postaxial border of the thigh of a divergent line in place of the hair-ridge which has been recorded in that situation (Boardman, 1943*b*).

A.I.A. male.—Fortunately, on this specimen the skin has been left over the groin and distal parts of the limbs, and, despite the fact that it is adult, charting of the tracts presented no difficulty.

Hair radiates from the scrotal pouch in all directions—forwards on to the abdomen, laterally over the medial aspect of the thigh and towards its postaxial margin (along this margin it encounters the current which apparently sweeps round over the buttocks as in the female and forms with it a hair-ridge), and caudally towards the cloaca (Fig. 2). The general pattern of hair in this region is determined largely by the presence of the convergent ridge formed postaxially along the thigh as mentioned and a divergent centre situated in the midventral line at the front of the base of the large hillock which has at its summit the external opening of the cloaca. On the hair-ridge running along the postaxial margin of the thigh, about opposite a point midway between the scrotum and the cloaca, there is a convergent interval which is caused by the



Figs. 1-2.—*Thylacinus cynocephalus*. 1. Hair tracts of the groin (*A.M.* female). The hair could not be charted on the area left blank. 2. Hair tracts of the groin (*A.I.A.* male). The skin had been removed from the regions beyond the zone marked with arrows.

diversion of the opposing currents proximally and distally, respectively. From the midventral divergent centre, hairs stream forward to meet the current flowing caudally from the pouch and form with it at the point of impact a divergent interval. Laterally the deflected hairs from this divergent interval pursue a recurved course outwards and caudalwards and merge with the current comprising the proximal end of the hair-ridge on the postaxial margin of the thigh. The current thus augmented describes an arc round the cloacal hillock behind which it divides, the cranial division recurving towards the base of the hillock while the caudal part proceeds along the ventral surface of the tail towards its tip; in consequence a midventral convergent interval is formed at the root of the tail.

Beddard (1891) has figured the scrotum and its pouch in *Thylacinus* and subsequently Pocock (1926) pointed out the inaccuracies in the figure and replaced it with one of his own. The hair tracts in the vicinity of the scrotum as described and figured by Pocock are not in accord with the condition observed and outlined above for the *A.I.A.* male. Pocock records that "the tips of the hairs all round the pouch were directed towards it, those in front pointing backwards, those at the side inwards, and those behind forward". In the three specimens before me, that is, in the *A.I.A.* male and two wet mounted preparations of the scrotum and its pouch (Plate i), the opposite is the case.

The currents on the surface of the scrotum originate on the stalk, from which they radiate round the sides of the sac to converge at the central point on its ventral aspect. The figures (Plate i) would seem to indicate that the convergent point is situated more caudally, but after examination of the scrotum *in situ* in the *A.I.A.* male, and considering the relationships of stalk and sac, I am inclined to regard this as an artefact.

Nothing further can be added to the account of the distal portion of the limbs previously described for the female (Boardman, 1943*b*); it is of interest that the convergent interval recorded as occurring laterally on the forearm is equally well delineated in the same position in this mature male.

*Facial Vibrissae.**

In 1914, Pocock, in a paper on the distribution of the various groups of facial vibrissae in the orders of mammals, took systematists to task for their neglect in comparative studies of these commonly occurring structures. As a result of his investigations he was able to state that the specimens he had examined were "sufficient to establish certain general principles as to the constancy or inconstancy of the occurrence of the tufts of tactile facial vibrissae within the limits of major groups". Pocock was preoccupied with a consideration of the vibrissae group as a whole and no attempt was made by him to count the actual number of vibrissae present in any particular situation. Later, Danforth (1925) took up the question of the constancy in occurrence of the individual bristles in a given situation, choosing the mouse as a type animal and considering particularly a selected number of vibrissae in the mystacial region. He found that "Individual vibrissae show a remarkable constancy in their one-to-one correspondence with the vibrissae of other animals of the same and even of different species". The theoretical significance of this interesting enunciation is not here relevant, but the suggestion to the taxonomist is pointed. For this reason I have set down in some detail the numbers, so far as they could be ascertained, of the facial vibrissae in their various groups in *Thylacinus*. Such a limited set of figures is, of course, of little or no statistical value, especially as most of them were secured from litter mates of the same age. Even so, the tables are of interest in that they imply that equality of number from specimen to specimen though constant in some situations is not, apparently, constant in others. For instance, the numerical constancy of rows IV and V of the mystacial group is, in the material examined, not found in the supraorbitals.

Mystacials.—The mystacial vibrissae are arranged in five principal rows. Above them there are what may be regarded as three further rows consisting each of only a single vibrissa placed towards the caudal margin of the mystacial zone; these three single vibrissae which appear to be constant in their occurrence will not be considered further. The occurrence of single supernumerary vibrissae between the rows and alternating with adjacent follicles is not infrequent. In recording, supernumeraries have been associated with the row to which they are nearest or in cases of doubt with the row above; their number is indicated separately in brackets (Table 1). The five rows considered are designated IV to VIII from above downwards. Counting on the *A.M.* female was made difficult by the density of the surrounding fur and the possibility of vibrissae having broken off; this specimen has a further row of weaker bristles with smaller follicles along the margin of the upper lip inferior to row VIII. No count could be made on the *A.I.A.* male.

TABLE 1.

The Distribution of the Mystacial Vibrissae.

Row.	R.3025♀.		R.3026♂.		R.3027♀.		R.3028♂.		*A.M.*♀.	
	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
IV	4	4	4	4	4	4	4	4	5	4
V	5	5	5	5	5	5	5	5	5	5
VI	6	6	6 (1)	6	6 (1)	6	6 (1)	5	6	7
VII	6	6	6 (1)	6	6 (2)	5	6 (1)	6	6	7
VIII	6	6	5 (1)	5 (1)	5 (1)	5 (1)	5	6	5 (1)	5?

* No vibrissae other than the various facial groups could be detected on the body at any stage.

The most notable feature presented by these figures is the numerical constancy of rows IV and V which, in only a single instance, differs from four and five vibrissae respectively. In the remainder of the series the extent of the agreement (leaving obvious supernumeraries out of consideration) in homologous rows is very marked.

Supraorbitals.—The supraorbital papilla is not very strongly developed; it is a low oval structure placed above the margin of the orbit somewhat behind the medial canthus. In the five specimens considered, the same number of vibrissae occurs on both the right and left sides except in R.3027 where there is a discrepancy of two, but the number, it will be observed, shows no constancy from specimen to specimen.

TABLE 2.

The Distribution of the Supraorbital Vibrissae.

Side.	R.3025♀.	R.3026♂.	R.3027♀.	R.3028♂.	*A.M.*♀.
Right	7	5	5	6	5
Left	7	5	7	6	5

Genals.—The genal papillae are low, of indeterminate extent and occupy the usual situation on the face; they are placed beneath the lateral canthus but above the level of the produced lip line. Figures for the number of vibrissae are available only for the *N.M.* series; the vibrissae are arranged on the papilla in two rows which run obliquely from above downwards and forwards; each row most generally contains a linear series of four vibrissae, but frequently vibrissae are absent or not developed.

Submentals.—The submental vibrissae occur in three rows which are as well defined and are as numerically constant as those of rows IV and V of the mystacial region. Figures could be determined only for the *N.M.* series. The rows are designated I–III, I being the lateralmost.

TABLE 3.

The Distribution of the Vibrissae in the Submental Area.

Row.	R.3025♀.		R.3026♂.		R.3027♀.		R.3028♂.	
	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
I	3	3	3	3	3	4	3	3
II	4	4 (1)	4	4	4	4 (1)	4	4
III	4	4	4	4	4	4	4	4

Interramals.—The interramal papilla on the *N.M.* group is, like the other facial papillae, not very prominent. Of the four specimens two have nine, two ten vibrissae issuing from the area covered by the papillar structure. It was not possible to count these vibrissae in the *A.M.* female.

Lips and Oral Fissure.

The lips of the *A.M.* female are fully formed. In the *N.M.* litter, however, they are sealed laterally in the manner characteristic of the marsupial mammary foetus, a circular aperture being left beneath the rhinarium for the teat to pass into the mouth cavity. The definitive lip line is indicated by a groove for most of its length.

Rhinarium.

Pocock (1926) has described and figured the adult rhinarium. The *A.M.* female differs in some minor points from his account. In the case of the *N.M.* group, the contours are quite different and can be correlated with the adult form only by inference.

N.M. litter.—The rhinarium is divided throughout into right and left halves by a deep median sulcus; the depth of the sulcus is such that, when viewed from above, the

rhinarium is deeply emarginate cranially. Below, just above the level of the lower limit of the nostril, the sulcus bifurcates and the two grooves thus formed run to the lateral margin of the rhinarium beneath the nares and so enclose a triangular area of skin which forms the upper part of the flesh surrounding the circular teat orifice. This triangular zone is equivalent to the philtrum of the adult animal; its length is shortened by modification consequent upon the requirements for the admission of the teat. The rhinarium is covered with a fine mosaic pattern, the units of which are outlined by shallow grooves pigmented (dark brown) except immediately above the opening of the nares. The mosaic area is cut off behind by a fairly clearly demarcated transverse line which also forms the diameter of an adjoining semi-circular naked zone beyond which hairs occur. Whether or no this naked part is to be regarded as part of the rhinarium proper could probably only be determined by sections; the presence or absence of hair follicles would, in all likelihood, be diagnostic in this case.*

The rhinarium extends beyond the margin of the upper lip, as described by Pocock for the adult, so that when viewed in profile its anterior face recedes downwards and backwards.

The nostrils are oval in outline with the long axes vertical; the opening is directed laterally rather than laterally and forwards as in the adult. There is a fairly deep infranarial area on each side. The philtrum, as recorded above, is shortened considerably by the adaptation of the mouth for sucking.

The rhinarium generally is darkly pigmented.

A.M. female.—In its broad features the rhinarium of the *A.M.* female does not differ widely from the description given by Pocock (1926) of the adult condition. It is naked and its separation from the surrounding haired skin is sharply defined. The philtrum is very wide and is interrupted below by a low rectangular excision from the corner of which a pair of grooves arises approximately parallel to each other. These two grooves and the median sulcus have the same relationship as described by Pocock. The fine mosaic pattern recorded (*v. supra*) in the pouch young is present in this larger female, but there are no signs of pigment deposition.

Eye.

In the *N.M.* specimens the eyes are unopened but the eyelashes of both the upper and lower lids have appeared and have pierced the investing epitrichium. The *A.M.* female has the eyes open and the upper and lower lids are covered with dense fur in common with the rest of the head.

External Ear.

N.M. litter.—These four specimens show the ear at an interesting early level of development which enables some suggestion to be made with reference to exact nomenclature of the parts. The pinna is different in shape from that of the adult, being bluntly pointed above and to the rear; it is thick and fleshy and is recurved so as to be adpressed against the skull. The definitive line of the anterior border of the external opening of the auditory meatus is difficult to determine; this point is considered below in connection with the *A.M.* female. Pocock's ridges *a*, *b* and *c* (1926, Text-fig. 29) are all clearly developed; *c* has the relationships of a tragoid projection with a pair of bulges opposite, which constitute, in all likelihood, a double antitragus (*at*, Fig. 3 A).

A.M. female.—Pocock (1926) has described at length and figured the adult ear. The architecture of this structure as found in the *A.M.* female follows in general Pocock's account with only minor variation in the size of the component parts. However, it seems advisable to provide a figure of this interesting specimen for comparative purposes and most of the differences will readily be apparent by comparing it with that given by Pocock. Pocock's ridge *b* will be seen to extend further forward in the *A.M.* female and there is no continuity in front with the ridge *a* as would seem to be indicated by his figure. Ridge *c* does not appear to have the function of "strengthening the border

* In a description of the rhinarium of *Perameles nasuta* (Boardman, 1943*a*) a similar area was noticed which in that species was, after comparison with the adult, regarded as belonging to the rhinarium proper.

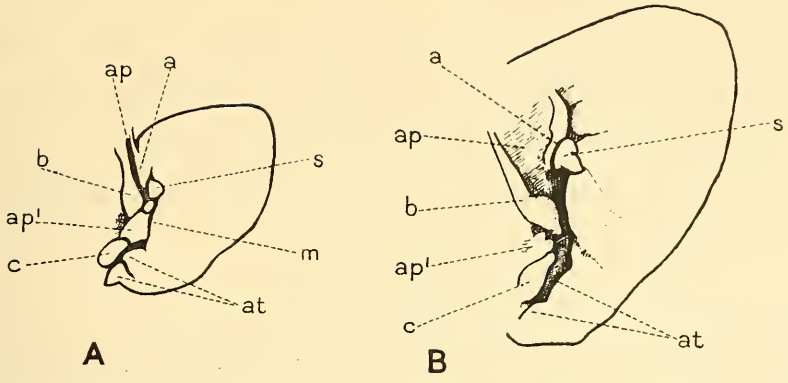


Fig. 3.—*Thylacinus cynocephalus.* The external ear. A, at the level of development seen in the *N.M.* litter; B, in the *A.M.* female. For explanation of letters see text.

of the inferior passage or cleft in front of the auditory orifice" since there is in this young stage very little that could be referred to as a border. It would seem possible that, in development, the cranial portion of the rim of the wall of the external meatus has been depressed or folded in two places giving rise to Pocock's "anterior passage" between ridges *a* and *b* and a further passage between ridges *b* and *c*, so that ridge *c* has the relationships of an isolated tragoid projection. Pocock has given a name to the upper passage, viz., "anterior passage". It seems that the lower passage between *b* and *c* is equally worthy of a name so that if it be desirable to retain the term "anterior passage", the two could be referred to as the "dorsal anterior passage" (*ap*, Fig. 3) and the "ventral anterior passage" (*ap'*, Fig. 3) respectively.

Feet.

The *N.M.* litter is too shrunken to be of use for examination in this connection. In all four specimens the claws are black-tipped.

The *A.M.* female shows only minor differences from the adult in so far as the manus is concerned. The discrete constituents of the plantar pad of the pes show to better advantage than in older specimens; their arrangement is as recorded by Pocock.

Female Pouch.

The structure of the female pouch is well known. In the earlier phases of its development as exemplified by the *A.M.* female and the still earlier *N.M.* litter there is little or no indication that the definitive pouch will open backwards. In fact, were the adult structure not known, it would be quite reasonable to assume that this pouch would develop to open forwards.

N.M. litter.—Two of these are females. The V-shaped appearance of the early pouch is present in a more precise form than in the *A.M.* female; the pouch depression is open in front, but closed behind. The nipples, two on each side, lie in a groove which is sunk beneath and parallel with the corresponding lateral lip.

A.M. female.—The forming pouch has at this stage thick lips laterally which converge and almost meet caudally and are slightly inflected cranially. The pouch thus formed is excavated for a short distance beneath the lips and also shallowly under the caudal margin; it is open in front, closed behind. The four nipples, arranged in two pairs, have the cranial pair spaced further apart than the caudal pair. This pouch shows none of the cranial overhang such as one finds, for instance, in *Dasyurus quoll* of an approximately comparable stage of development.

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EXPLANATION OF PLATE I.

Thylacinus cynocephalus.

1.—The *A.M.* female. Note the transverse stripes on the lower back.

2.—A female (R.3027) from the *N.M.* litter.

3-4.—The two wet preparations of the scrotum and its investing pouch (*A.I.A.* series). Both are from adult or nearly adult animals.